EXCERPTS FROM THE DEPARTMENT RECORD

4. WILDLIFE

b. Agency review comments (MDIFW & USFWS)

METHODOLOGIES FOR EVALUATING BIRD AND BAT INTERACTIONS WITH WIND TURBINES IN MAINE

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in collaboration with the

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INTRODUCTION

The methodologies described below are the second part of a two part document prepared by the Maine Windpower Siting Stakeholder Committee. Part I addresses the circumstances under which wildlife studies are recommended.

RATIONALE FOR RECOMMENED STUDIES

Songbirds are often the primary focus of pre- and post-construction studies at wind power developments in the eastern United States. Bird migration has been studied using radar for decades (Able 1970). It is widely accepted that songbirds migrate at night across broad fronts rather than along specific flyways. In mountainous regions, there is growing evidence that local topography may influence the movements, direction of travel, and perhaps altitude of migrating birds (Williams et al. 2001). In recent years dozens of studies have been performed and the amount of information collected is expanding. Despite these advances in our understanding, gaps in our knowledge remain. Well designed studies, including collection of site-specific data on bird use and passage rates are still limited due to the proprietary nature of studies associated with permit applications. Once these studies are public, the will likely assist us in evaluating potential risk to migratory birds. The cumulative knowledge of bird migration from ongoing studies associated with windpower may be used to help developers locate wind turbines in areas that minimize potential impacts to migratory birds.

Interactions between bats and wind turbines are also poorly understood at the present time. However, fatalities of birds and bats occur at wind farms worldwide, including in Australia (Hall and Richards 1972), North America (Erickson et al. 2002, Johnson et al. 2003, 2005, Fiedler 2004, Kerns and Kerlinger 2004, Arnett 2005), and northern Europe (Ahlen 2002, 2003). Bat fatality at wind farms received little attention until 2003 when 1,400–4,000 bats were estimated to have been killed at the Mountaineer Wind Energy Center in West Virginia (Kerns and Kerlinger 2004). Prior to the Mountaineer survey, most survey efforts at wind farms had failed to consider the potential impact of wind turbines on bats. The combination of nocturnal habits, small size, and variation in resource dependence (i.e., species vary in roost, water, and food resource dependence; Findley 1993) have made even a rudimentary understanding of how bats interact with their environment difficult to establish (Gannon et al. 2003). Post-construction monitoring has provided most of what little information that has been gathered to date on bat fatalities at wind farms (Johnson 2003). Pre-construction surveys at wind farms have been conducted and most commonly employ mist nets and acoustic detectors to assess local bat species presence and activity, but using this information to predict bat fatality and, thus risk at a site has proved to be challenging.

I. Methodologies for Nocturnal Studies of Birds and Bats Using Radar

Limitations

Maine's Wind Power Advisory Group recognizes that other radar detection equipment and methodologies are currently available for use, and that the following description of equipment and methodologies are not the only means for monitoring avian (i.e., nocturnal passerine and daytime raptor) migration. Competing processes are available and should be assessed on their own merits and functional capabilities.

Further, the Maine Wind Power Advisory Group recognizes that continued scientific and technical advances are regularly being made in terms of understanding regional and local bird and bat migration patterns and behavior, along with technical advances for monitoring migration movements and individual species behavior. As a result, it is important that those involved with assessing avian impacts recognize the capabilities and limitations of existing equipment and methodologies, and that they anticipate further ecological and technical advances as the experience and knowledge base develops. Adjustments to the following methodologies may be necessary to account for these advancements in technology and understanding of individual species behavior.

Radar is a useful tool for monitoring the flight of animals at night when simple observation is not possible. It may be possible to use radar during the day to detect diurnal migration of species such as shorebirds raptors and waterfowl. However, radar itself cannot distinguish between birds, bats and insects. Techniques are available to correct for the number of insects detected, but the relative number of birds and bats cannot be discerned at present. The numbers of targets observed on radar, although commonly referred to as birds, are actually a combination of birds and bats. In addition, an individual target may be one or more individuals within a flock.

Objectives

Radar studies should at a minimum address the following general objectives:

1. Document overall passage rates for nocturnal migration in the vicinity of a specific project area, including the number of migrants,
2. Investigate how migrants are using the project area, especially their flight direction and their flight altitude.
3. Examine if migrant flight, in relation to topographic features (e.g., saddles in ridgelines), is possibly unique to the project area.

Data collected to meet these objectives can be compared among sites to provide a relative assessment of risk. Unfortunately, few radar studies have been conducted where mortality also was monitored. Until studies are conducted at existing facilities with measured mortality levels of migrants, we are resolved to relative risk comparisons.

Equipment and Methods

A variety of parameters influence the success and effectiveness of night migration studies. These include:

Type of radar detection equipment

Two different types of radar (X, S-bands) are frequently used for studying migration and each has the potential for varying power outputs. These radar systems have advantages and disadvantages (Appendix III). Survey efforts to date in Maine have otherwise involved 12 or 25 kilowatt, X-band units. This type of unit is portable and has the ability to track small animals, including birds, bats, and even insects based on settings selected for the radar functions. Insect targets can be removed by correcting for speed of travel (see data analysis section below). Data collected by X-band radar is an acceptable means for meeting objectives as previously described. S-band radar has the advantage of being able to operate during rain, but its wavelength is likely to underestimate the number of small targets and consequently passage rates will not be comparable to other studies previously conducted in Maine or elsewhere. S-band radar can be automated so that all the data is stored for later retrieval. Automation allows for sub-sampling of data and/or independent analysis. Simultaneous use of both X-band (pointed vertically) and S-band (pointed horizontally) may offer several advantages (see Appendix IV).

A third type of radar that may be useful at some sites is **NEXRAD** or (Next-Generation Radar), which is a network of 158 high-resolution Doppler radars operated by the National Weather Service. NEXRAD weather radar is useful for determining timing and general location of broad fronts as they pass through large geographic areas when used in conjunction with x and/or s-band radar. The use of this data may be too coarse for individual or localized site assessments unless the project area is within 10-20 miles of an existing NEXRAD site.

Location of radar site

Because of the limited range of the x and s-band radar units when used to monitor movements of small animals, proper location of the radar unit is critical. Units should be positioned to adequately cover the project area and in a way that limits ground clutter. Proper radar placement includes the use of nearby landscape features, such as tree lines and hilltops, to mask out large areas of ground clutter while maximizing the view that the radar has of the surrounding airspace. Thus, the volume of air space is monitored. Further, the position of the radar antenna when operated in a surveillance mode can be modified (i.e., tilted) to more effectively sample air space around the site. Consequently, each project area requires site-specific considerations. Radar should be placed to permit assessment of the actual turbine locations (i.e., ridgeline areas and especially saddles). Radar studies based solely on low elevation (valley) or off-site assessments do not meet objectives outlined above, are not suitable to assess site-specific risk, and are therefore not encouraged.

Equipment operational settings

To detect small targets such as birds and bats, X-band radar should be operated at a range of 1.4 kilometers (km) (0.75 nautical miles). The unit's anti-rain and anti-sea settings should be lowered and the gain turned up. The radar should be operated at its shortest pulse length to increase the detection of small targets, with a radar echo trail set to adequately assess direction, normally 30 seconds.

Equipment operational modes

Two operational modes should be utilized during each survey hour to assess local avian movements. In the first mode, surveillance, the antenna spins horizontally to survey the airspace around the radar. During which time, it detects targets moving through the area. By analyzing the echo trail, flight direction and speed of targets can be determined. In the second mode of operation, vertical, the antenna is rotated 90° to survey the airspace directly above the radar. In vertical mode, target echoes do not provide directional data but do provide information on the altitude of targets passing through the vertical beam (through or above the project area).

Seasonal surveillance period

The seasonal duration and frequency of individual night effort during the migration period is a key factor in ensuring an appropriate level of sampling for early, mid, and late season migrants, as well as the effects of seasonal weather fronts. In most cases, pre-construction radar monitoring should occur over at least one fall and one spring migration season and the results should be part of the application. For very large projects or those to be conducted in phases, radar studies should reflect the magnitude and complexity of such projects. For small projects or sites considered lower risk due to habitat or topography, adjustments in data submitted may be appropriate. Multiyear/multiphase projects may require a multiyear effort to adequately understand migrant behavior at a proposed site. It may be appropriate to limit required studies when project areas are within close proximity to other sites that have collected adequate data, or are otherwise determined to present a limited avian migration risk (e.g., limited number of turbines). For each season, at least 20-30 nights, representing various weather fronts over the course of a migration season, should be monitored. Though influenced by latitude and seasonal conditions, spring survey periods typically should be run between April 15 and May 31; and fall surveys between August 15 through October 31.

Nightly surveillance period

Peak nightly migration rates typically occur 4 to 6 hours after sunset. However, variations due to seasonal and weather-related effects can occur. Survey efforts commonly are initiated at or ½ hour before sunset and terminated at or ½ hour after sunrise. Because the anti-rain function of the X-band radar must be turned down to detect small songbirds and bats, surveys cannot be conducted during periods of inclement weather. However, surveys can be conducted in fog. To characterize migration patterns during nights without optimal conditions, nights with weather forecasts including occasional showers should also be sampled.

Data Collection

The radar display should be connected to video recording software to allow permanent data archives. Crude techniques that rely on tallies in real time or by hand transfer from mylar are unacceptable as they introduce bias resulting largely from observer fatigue. Archived data should be regularly backed up, stored on a hard-drive and include an adequate sample size for statistically assessing the number of migrants, their flight direction, and their flight altitude for each night and season. Summary statistics should be used to conclusively demonstrate adequacy of sampling. As an example, during surveillance mode, 15 randomly spaced, one-minute samples of the radar display are recorded for every survey hour. During vertical mode, ten, one-minute, samples are randomly selected for each survey hour.

Supporting Data

Additional data and site information (i.e., weather, ceilometer data) should also be collected during the course of field investigations as part of the risk analysis. Recorded weather data includes wind speed and direction, cloud cover, temperature, and precipitation. Ceilometer observations involve directing a one million candlepower spotlight vertically into the sky as described by Gauthreaux (1969). The ceilometer beam is observed by eye for 5 minutes to document and characterize low-flying targets and held in-hand so that birds, bats, or insects passing through it can be tracked for several seconds, if needed. On nights with a full moon and clear skies, the ceilometer beam is too diffuse to readily detect birds and bats. On those nights, moon watching (Lowery 1951) may be used, which involves watching the face of the moon with binoculars for 5 minutes and recording the numbers of birds, bats and insects observed flying in front of the moon. This information is secondary for assessing risk, but may be used during the data analysis to help distinguish insects from bird and bat targets.

Other possible verification techniques include acoustic recording devices that monitor migratory vocalizations that can be used to identify species and infrared cameras or night-vision goggles.

Data Analysis

For surveillance (horizontal) samples, examining speed of recorded targets, after correcting for wind speed, helps to identify insects versus birds and bats. In general, and barring other apparent movements, targets traveling faster than approximately 6 m per second – after correcting for wind speed and direction - are considered a bird or bat target Recordings should include time, location, and flight vector (azimuth) for each target traveling fast enough to be a bird or bat. For vertical samples, recorded entries should indicate the time and flight altitude above the radar location. These datasets are used to calculate passage rate, flight direction, and flight altitude of targets.

Hourly passage rates (i.e., in 1-hour increments post sunset) are estimated by tallying the total number of targets within shorter time periods (e.g., 1-minute samples) during each hour. The number of targets then can be extrapolated to the entire hour. That estimate is then corrected for the radar range setting used in the field and expressed as targets/km/hour (t/km/hr) ± 1 standard error (SE). The hourly rates are used to calculate passage rates for each night and the entire season. Mean target flight directions (± 1 circular SD) are summarized in a similar manner: by hour, night, and season. Flight altitude data are summarized using standard linear statistics. Mean flight altitudes (± 1 SE) are calculated by hour, night, and overall season. The percent of targets flying below the approximate maximum height of proposed wind turbines are also calculated hourly, for each night, and entire survey period.

A two radar configuration consisting of a vertically operated X-band radar (10-25 kW power) in conjunction with a horizontally operated S-band radar (30-60 kW power) has been used in other states. The X-and S-band radars use different frequencies and therefore can be operated together, collecting data in both the vertical and horizontal directions. An advantage of the fully automated, computer-based S-band radar survey system is the ability to collect data continuously and to sub-sample or resample the data at any time.

II. Methodologies for Diurnal Surveys of Migratory Birds

One of the earliest indications that wind energy development could pose a hazard to birds resulted from raptor mortality in California's Altamont Pass (Howell and DiDonato 1991, Orloff and Flannery 1992). The Altamont Pass Wind Resource Area (APWRA) has a history of high raptor mortality (Orloff and Flannery, 1992, 1996; Smallwood and Thelander, 2004). The APWRA consists of approximately 5,000 mostly small (< 200 kW) older model wind turbines located within a 60 square mile area. This site has very high year-round use by raptors, including breeding golden eagles, burrowing owls, red-tailed hawks, and other owl species, and high migrant and winter raptor use. As habitat conditions, tower design, number of turbines and raptor populations differ so greatly between Altamont and those being proposed in Maine, large-scale raptor mortality is not anticipated in Maine. However, Maine has a robust yet recovering population of Bald Eagles that remain state and federally listed as Threatened Species. Complicating this is an increase in the number of Bald Eagles along the coast during winter, occasional sightings of Golden Eagle, and a recovering Peregrine Falcon population. Maine is not well known for its hawk watching, but several sites tally Broad-winged Hawks by the thousands each fall.

Diurnal surveys are typically conducted to describe the species that use the proposed site. Radar studies alone cannot distinguish species passing through a project area, and radar studies have tended to focus on nighttime movements. Acoustic surveys have also been conducted in Maine. However, these surveys only identify calling species in range of the recording units. One technique that has been used instead is to conduct surveys during a series of mornings to categorize birds (primarily migrating songbirds) that are using the project area through the migration season. This operates on the key assumption that the species numbers and diversity observed after dawn at a site relate, in at least a crude way, to the targets seen during nighttime radar observations.

Objectives

1. Document the occurrence of migrating raptors in the vicinity of the project area with emphasis on species composition, numbers, and flight patterns including direction and approximate flight height.
2. Document the composition of migrant passerines that stopover within the project area as a potential index to species composition of bird targets documented during radar studies.

Raptors

Direct observations should be used to document migration activity of raptors and other diurnal migrants. This method is used by the Hawk Migration Association of North America (HMANA), which coordinates surveys of hawk migration activity throughout North America and promotes the use of standard reporting forms and procedures.

Concerted efforts should be made to schedule visual survey days when favorable winds are forecast.

Diurnal/raptor migration surveys should be conducted at appropriate locations in the project site on a minimum of six (6) survey days in spring and ten (10) survey days in fall. Surveys should generally be conducted between 9 am and 5 pm. Survey dates should be scheduled to coincide with historically documented peak migration periods for Red-tailed, Broad-winged, and Sharp-Shinned Hawks. These survey efforts should be scheduled on days with suitable migration weather conditions, that is days following movement of warm fronts with strong southerly winds in spring, and during and following the passage of cold fronts with steady northwesterly winds in fall. Observations of all migrants, including waterfowl, shorebirds, and miscellaneous passerines, should be recorded on HMANA data sheets (HMANA, 1998). During each survey count, the number of individuals observed, by species, should be recorded for each hour of observation. Data should be reported by species as number of migrants/km/hour. Observations on approximate height above ground and general behavior should also be recorded. Approximate locations of observed birds also should be indicated on a site map. Study results can be used as an index of raptor use and then be compared to data recorded at other regional study sites to describe migration activity at the project site from a regional perspective.

Stopover Passerines

Stopover surveys typically collect data from about dawn through 1000 hrs along transects or at point count stations located at a variety of elevations and habitats in an attempt to catalog these birds. Data should be presented as abundance of individual species per transect or habitat type. Scheduling of stopover counts should follow with nights representative of high, moderate, and low intensity as indicated by radar. Further surveys should be conducted in both spring and fall and cover 10 to 15 mornings scattered throughout the migration season and include mist netting for verification..

Field methods for addressing the magnitude and timing of individual species movements through a project site may be indirectly assessed if impacts to rare species are anticipated.

III. Methodologies for Bat Studies at Wind Power Facilities in Maine[1]

Bat fatality at wind energy facilities has been a serious concern at a few sites, yet little is known about the causes or even the mechanisms that lead to collisions with wind turbines. Acoustic monitoring allows researchers to detect and record various calls of echo-locating bats passing through a wind development site. These data can be used to assess relative activity and identify species (or groups of species), but are not without limitations.

Acoustic detectors often are used in the field without a thorough understanding of underlying assumptions and limitations or standardized protocols (Hayes 2000, Weller and Zabel 2002). Furthermore, most past and current efforts to acoustically monitor bat activity prior to construction of turbines suffer a number of design problems, including small sample sizes, poor temporal and spatial replication (Hayes 1997, 2000), pseudo-replication (Hurlbert 1984), and inappropriate inference because limitations and assumptions were not understood or clearly articulated (Hayes 2000, Gannon et al. 2003). Only a limited number of post-construction mortality studies have been initiated in the United States. Arnett (2005) has noted mortality rates correlated positively with detection rates, suggesting that pre-construction surveys can be useful in determining the need for an additional, quantitative risk assessment. Regardless, additional studies linking pre-construction monitoring data with post-construction fatality represent a critical link necessary for understanding the potential risk of wind farms to bats.

When deemed necessary as part of a regulatory process or undertaken voluntarily by applicants, the Advisory Group recommends use of acoustic detectors for enumerating bats at a proposed wind facility during pre- and post-construction phases. This information should be compared to post-construction estimates of bat fatalities to achieve the most complete assessment of adverse impact. Studies should include 2 phases. Phase 1 should consist of a pre-construction assessment of bat activity using acoustic detectors. Phase 2 should involve monitoring of bat activity at the same sites after turbines are constructed, with concurrent monitoring of bat fatalities. Study design should be of sufficient rigor to address the following objectives:

Objectives

1. Determine activity of different bat species (or groups) using or migrating through wind development sites prior to and after construction.
2. Relate indices of pre-construction bat activity to post-construction bat activity and fatalities.

[1] Excerpted by Maine Wildlife Wind power Advisory Group from: **An evaluation of the use of echolocation monitoring to predict bat fatality at a proposed wind facility in south-central Pennsylvania (27 June 2005)**; Edward B. Arnett, Bat Conservation International, Austin TX 78746 and Dr. John P. Hayes, College of Forestry, Oregon State University, Corvallis OR 97331

3. In the event of significant bat mortality, be able to evaluate patterns of post-construction bat fatality in relation to weather conditions and other environmental variables that might suggest possible mitigation measures.
4. Contribute to the knowledge of temporal and spatial variation, and sample size requirements that may help refine methodologies for future acoustic detector studies, if required.

Equipment and Field Methods (acoustic surveys: current best practices)

Monitoring Bat Activity

A variety of different acoustic detector systems, each with their own associated software, are available for detecting the presence of bats, e.g., AnaBat and ANALOOK software, Petersson and Sonobat (J. Szewczak, Humboldt State University). Each system is used for distinct purposes, has its' inherent benefits and limitations, and if improperly applied or used, will fail to meet the investigation objectives (Fenton 2000, Fenton *et al.* 2001). Consequently, as with radar investigations, properly defining the survey objectives and understanding how the various systems work are both critical to selecting and using the appropriate survey tool.

Bat echolocation calls should be recorded with acoustic detectors (e.g., Anabat II zero-crossing ultrasonic detectors and CF-ZCAIM storage unit, Titley Electronics Pty Ltd, Ballina, NSW Australia) deployed during both spring (1 April – 30 May) and fall (15 July through 31 October) migration periods for 1 year (1 spring and 1 fall) during the pre-construction phase and for at least an additional year during the post-construction phase. Each detector should be synchronized and programmed to record calls from ½ hour past sunset to ½ hour before sunrise continuously during sampling window outlined above. Stored data can then be sub-sampled to estimate bat activity

Acoustic sampling should occur at two different heights, reaching into the rotor-swept area (Figure 1) and be scaled according to the size of the proposed project. Generally, one detector array (see Figure 1) should be established per 10 proposed turbines. Alternately, each meteorological tower should be affixed with two bat detectors at two different heights (Fig. 1). Consequently, met towers should be equipped with a non-corrosive pulley system to permit raising bat detectors at some time in the future later in the monitoring protocol if required.

Anabat detectors should be calibrated according to Larson and Hayes (2000) and recalibrated weekly. Detectors should be rotated at a particular tower and among the different heights to ensure no particular detector is consistently used at any one height to ensure that any variation in individual detector sensitivities does not skew data. Data from detectors should be regularly downloaded throughout the sampling period and any non-bat ultrasonic detections eliminated. Integrating automatic temperature recorders (e.g., Hobo® meters) at individual detection sites may also prove useful in the subsequent assessment of bat behavior and movements at the site.

Mist-netting bats can be used to confirm species that are present during the census window and would confirm dates when migratory bats are active at various locations in Maine.

Species Identification

Post-collection analysis of the continuous acoustic surveys should be done to determine number, frequency, and timing of individuals and individual species present. Successful identification requires familiarity with appropriate matched software, e.g., ANALOOK for AnaBat, and access to a suitable reference call library; calls of known species from existing call libraries are available at various sources, e.g., www.batcalls.com, as well as those from individuals captured locally on the study area with mist nets. All calls should be archived for later reference.

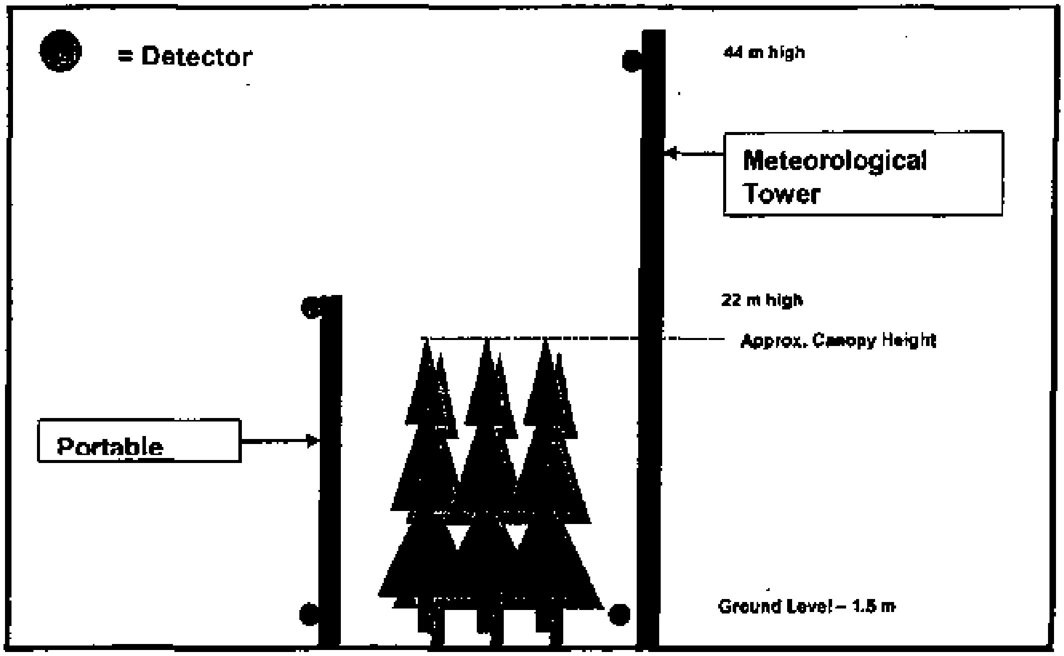
Analysis

Calls should be categorized and analyzed by the following species groups derived from Gannon et al. (2003): 1) *Myotis*; 2) *Lasiurus borealis-Pipistrellus subflavus*; 3) *Eptesicus fuscus-Lasionycteris noctivagans-Lasiurus cinereus* (all based on similar minimum frequency and shape of call (Thomas 1988); and 4) unidentified.

Summary statistics should describe patterns of activity and spatial (among heights and sampling points), temporal (within and among nights), and taxonomic variation in use. A bat detection is defined as a call sequence of duration greater than 10 ms and consisting of 2 or more individual calls (Thomas 1988, O'Farrell and Gannon 1999, Gannon et al. 2003). The number of bat passes[2]/hr/sampling unit (Crampton and Barclay 1998, Miller 2001, Gannon et al. 2003) should be used as an index of activity. These data should be used to evaluate relationships between pre-construction activity data and post-construction patterns of use, as well as relationships between recorded levels of activity and post-construction fatalities.

[2] Bat passes are used as an index since acoustic sensors do not recognize individuals and cannot determine the number of times any individual bat passes through the detection area.

Figure 1: Depiction of the vertical array of acoustic detectors to be used at portable (left) and meteorological (right) towers



IV. Post-Construction Avian and Bat Fatality Study Methodologies

Mortality of birds and bats has become one of the primary concerns of conservationists following construction of wind energy facilities. Recent findings indicate that mortality of bats may be greater than for birds at some sites. For example, bat mortality at the Mountaineer Wind Energy Center in West Virginia may represent the largest wildlife kill ever reported for wind turbines, with estimates of total bats killed ranging from 2092 (Kearns & Kerlinger 2004) to 4000 (Merlin Tuttle, pers. comm. 2004). Mortality of birds and bats is recognized as being highly site dependant (Erickson et. al. 2002). Despite a lack of understanding surrounding the mechanisms of bird and bat strikes at wind energy developments, counts or estimates of the number of individuals killed are the most tangible means of assessing impact and consequently defining mitigation. Most permit applications should provide a prediction of anticipated mortality of birds and bats. Mortality studies are then conducted post-construction to determine if estimated actual mortality is in line with predictions and whether mitigation efforts would be required.

Unfortunately, fatal strikes of dead bats and birds are not easily enumerated. Accurate counts of the number of birds and bats fatally striking wind turbines, towers or other associated structures is greatly influenced by surrounding vegetation and the likelihood of scavenging by other birds or mammals. In agricultural or grassland/barren settings, searching would only be impeded by low vegetation and counts should closely reflect (or index) actual numbers of mortalities. In forested, and especially montane or steep rocky areas where either a dense understory exists or vegetation is stunted and dense, ease of travel and the ability to see dead animals could be greatly limited. Some have suggested the use of trained dogs to assist in search efforts. This idea has merit, although birds or bats suspended in vegetation several feet above ground will limit the efficacy of using dogs. The lack of availability of trained dogs has been cited as a limitation as well.

Scavenging at a site, for example by ravens or raccoons,, could also result in underestimates of mortality. Scavenger population density should be considered as such small carcasses could be easily and quickly removed. At all new developments (as opposed to permits for subsequent phases of an initial development), scavenging could potentially be less than at sites with a long history of meteorological or communications towers (Tom Hodgman, MDIFW pers. Comm..). At all sites, the amount of time between searches should be minimized to reduce the opportunity for scavenging.

Some mortalities may be a result of natural mortality and not be a result of colliding with wind energy structures. Currently, only a few studies have attempted to estimate such "background mortality" (Johnson et. al. 2000, Harmata *et al.* 1998, Anderson et al. 2005). Assuming carcasses are wind turbine related could lead to an overestimate of the true number of wind development-related fatalities. However, other studies have shown that searcher efficiency rates for bat carcasses as low as 25% at one site in Pennsylvania and only reached 44% at a site in West Virginia (Kearns et. al. 2005) indicating a high percentage of carcasses associated with collision events are never found. Studies on the rate at which scavengers removed carcasses underneath turbines was 3% at a site in

Pennsylvania and 70% at a site in West Virginia during a 24 hour period (Kearns et. al. 2005). The added costs associated with obtaining accurate estimates of natural or reference mortality may not be significant enough to justify more detailed enumeration.

Monitoring Protocol for Non-Forested Sites

Agricultural fields, grasslands or other treeless landscapes lend themselves to intensive ground searches for finding fatalities at wind turbine sites. Even at these "barren" sites, searcher efficiency and rate of scavenging should be addressed.

Study Duration

Mortality studies of birds and bats after a facility is constructed and operational should be conducted for a 2-3 year period (i.e., 2-3 spring and 2-3 fall migration seasons) conducted within 5 years of the start of operation. Multiple years of data are currently needed due to the fact that fatality studies at wind turbine sites do not exist for any habitats in Maine. Less than 2-3 years of data collection may be considered if the project is relatively small (3 or less turbines) or if similar and representative mortality studies have already been conducted within the region and in similar habitats and a strong case can be made that these data can be used to predict mortality at the wind power site in question.

Longer term research orientated studies may be appropriate at some sites but may need to be a collaborative effort and not the sole responsibility of a wind power developer.

Objectives

The primary objective is to estimate the range of annual or seasonal avian and bat mortality caused by a wind turbine facility. A fatality monitoring study designed to meet this objective should consist of the following components:

1) Standardized carcass searches at selected turbines representing 30% of the project;
2) Searcher efficiency trials to estimate the percentage of carcasses found by searchers;
3) Carcass removal trials to estimate the length of time that a carcass remains in the field for possible detection and
4) An Incidental Handling and Reporting System for wind project personnel to handle and report casualties found in the project incidentally to the study.

Field Methods

Search Plot

Rectangular, square or circular plots should be delineated around selected turbines or turbine strings and any guide met towers. Some prefer to search rectangular or square plots associated with turbines to make it easier to navigate and orientate during the searches. Others prefer circular plots, to maximize efficiency by not searching areas with typically lower probability of finding a carcass. A general guideline is to search a minimum distance from turbines equivalent to the distance from ground level to the maximum height of the rotor swept area. Studies at wind plants with other large turbines, Klondike in Sherman County Oregon (Johnson et al. 2002), and Combine Hills, Umatilla County, Oregon (Young et al. 2005) indicate a very large proportion of the fatalities are found within the area that is roughly equivalent to the height of the turbine. In forested environments, the distance from the turbine to the forest edge is usually much shorter than this distance to maximum height of the rotor swept area. It is recommended that the forest edge be used to define the search plot edge in those cases. In cases when a measurable proportion of the fatalities may occur outside the plot, adjustments to the fatality rates based on estimates of the likelihood of fatalities existing outside the plot should be considered.

In some cases, it is recommended that areas around turbines be cleared of vegetation to allow for higher detectability of fatalities, if such activities are permissible. Agricultural practices may need to be altered depending on specific crop standing at time of survey. For example, corn may need to be harvested before surveys could be successfully completed. Vegetation may also need to be cleared in forested areas, if monitoring occurs after vegetation has overgrown the cleared areas. However, the effects of habitat fragmentation should be considered prior to any large scale clearing.

Comment [J11]: 11 acres may be a lot to take out of agriculture.

Search Interval

The length of the interval between searches should depend on the scavenging/carcass removal rate. Because of the extreme variability between sites, carcass removal trials should be conducted prior to the fatality searches to determine optimal search intervals. Although projects in the eastern U.S. have used 3 to 7-day search intervals when carcass removal rates are not high, the search interval should reflect scavenging conditions at the site. If carcass removal rates are particularly high, search intervals should be adjusted accordingly.

Standardized Carcass Searches

Personnel trained in proper search techniques should conduct the carcass searches. Methods may need to be adjusted to take into account site-specific considerations. In general, the methodology should be based on using parallel transects approximately 6-12 meters apart across each plot. Searchers walking at a rate of approximately 45-60 meters a minute along each transect. This would result in approximately 45 to 90 minutes to search each turbine plot. Searchers should scan the area for casualties on both sides of the transect out to approximately 3-6 meters, depending on the visibility and complexity of surrounding vegetation, as they walk each transect. Transect widths and speed may be adjusted by habitat type after evaluation of searcher efficiency trial data.

All casualties located within areas surveyed, regardless of species, should be recorded and a cause of death determined, if possible, based on field inspection of the carcass. Some carcasses may be necropsied if researches suspect a non-wind turbine related death. The condition of each carcass found should be recorded using the following categories:

- Intact - a carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger.

- Scavenged - an entire carcass, which shows signs of being fed upon, or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, portion of a carcass, etc.), or a carcass that has been heavily infested by insects.
- Feather Spot - 10 or more feathers or 2 or more primaries at one location indicating predation or scavenging.

All carcasses found should be labeled with a unique number, bagged and frozen for future reference and possible necropsy. A copy of the data sheet for each carcass should be maintained, bagged and frozen with the carcass at all times. For all casualties found, data recorded should include species, sex and age when possible, date and time collected, GPS location, condition (i.e., intact, scavenged, feather spot), and any comments that may indicate cause of death. All casualties located should be photographed as found and plotted on a detailed map of the study area showing the location of the wind turbines and associated facilities such as overhead power lines and met towers.

Casualties found outside the formal search area by carcass search technicians should be treated following the above protocol as closely as possible. Casualties found in non-search areas (e.g., near a turbine not included in the search area) should be coded as incidental discoveries and should be documented in a similar fashion as those found during standard searches.

Casualties found by maintenance personnel and others not conducting the formal searches should be documented using an incidental reporting system. This system should be in place for the life of the project and follow the same labeling, archiving, and data recording procedures as standardized carcass searches.

Any injured birds or bats found must be carefully captured and transported to a rehabilitation center. A specific protocol for handling injured birds (including copies of state and federal permits to authorize such activity along with a list of licensed rehabilitators must be presented to regulatory agencies at the time of application.

Searcher Efficiency Trials

Comment [JJ2]: DIFW - See Vermont version - may want to include or replace?

The purpose of searcher-efficiency trials is to estimate the percentage of carcasses found by searchers. Estimates of searcher efficiency should be used to adjust the total number of carcasses found for those missed by searchers, correcting for detection bias. Searcher efficiency trials should be conducted in the same areas carcass searches occur. Trials should be conducted by season and separately in all affected habitat types. At a minimum, searcher efficiency should be estimated by major habitat type, size of carcass, and season.

Searcher efficiency trials should begin when carcass search studies begin. During each season and within the major habitat types, birds of at least two different size classes should be placed in the search area during the search period. Personnel conducting carcass searches must not know when trials are conducted or the location of the detection carcasses. It is recommended that multiple trials be conducted each season to incorporate within season variability. The number of trial carcasses used should depend on the variation in habitats within and among seasons. Estimates should be made for both birds (at least two size classes) and bats, if available. Appropriate state and federal permits must be in place to use protected bird species (e.g., birds protected by MBTA). Carcasses/carcass parts should be representative of the species likely to be found as fatalities.

All carcasses/carcass parts should be placed at random locations within areas being searched prior to the carcass search on the same day. If avian scavengers appear attracted by placement of carcasses, the carcasses should be distributed before dawn. Carcasses should be placed in a variety of postures to simulate a range of conditions. For example, birds should be: 1) placed in an exposed posture (tossed randomly to one side), 2) hidden to simulate a crippled bird, and 3) partially hidden.

Each trial carcass should be discreetly marked so that it can be identified as a study carcass after it is found. The number and location of the detection carcasses found during the carcass search should be recorded. The number of carcasses available for detection during each trial should be determined immediately after the trial by the person responsible for distributing the carcasses.

The number of carcasses to use should depend on the target precision for fatality estimates, variation in habitat and observers, and other factors.

Carcass Removal Trials
The objective of carcass removal trails is to estimate the average length of time a carcass remains in the study area and is potentially detectable. Estimates of carcass removal should be used to adjust the total number of carcasses found for those removed from the study area, correcting for removal bias. Carcass removal includes removal by predation of injured/crippled individuals, scavenging of carcasses, or removal by other means such as being plowed into a field. Carcass removal studies should be conducted during each season of study in close proximity but not within the carcass search plots (e.g., near a turbine that is not included in the standard search plots).

Carcass removal trials (experimental) should begin prior to the carcass searches related to mortality studies in order to aid in defining search intervals. During each season of study and within major habitat types, carcasses of birds of at least two different size classes (same as searcher efficiency birds) should be placed in the study plots. Care should be taken (use of latex gloves, rubber boots) to reduce attracting scavengers to trial carcasses. If permissible, and if fresh fatalities (e.g., those that occurred previous night) are found during carcass searches, these should not be disturbed and left in place and monitored. Carcasses should be placed on a minimum of two dates during each study season to incorporate the effects of varying weather, climatic conditions, land use practices, and scavenger densities. Legally obtained fresh bat carcasses should also be used, if available. It is logistically difficult to use never frozen carcasses in these trials. If previously frozen carcasses are used, these carcasses should have been fresh when frozen, and should be bagged, and time in freezer should be minimized to reduce deterioration prior to placement.

Birds used for removal trials should not be placed in the standardized search plots to minimize the chance of confusing a trial bird with a true casualty. Turbines not included in the standardized searches should be randomly selected for including in the removal trials and trial carcasses should be randomly located in a similar size plot to search plots around the turbine. If all turbines are being searched, locations such as along access roads might be selected, but should be in similar habitat as the search plot. If those areas are not available, trial birds might be located in standardized search plots, but care should be taken to not confuse these trial birds with actual fatalities. Trial carcasses should be placed in a variety of postures to simulate a range of conditions. For example, birds should be: 1) placed in an exposed posture (tossed randomly to one side), 2) hidden to simulate a crippled bird (e.g., placed beneath a shrub or tuft of grass), and, 3) partially hidden.

Personnel conducting carcass searches should monitor the trial birds over a period longer than the interval between searches. For example, if searches are conducted on a weekly interval, a schedule for monitoring the fate of the removal trial birds might be to check the carcasses every day for the first 4 days, and then on day 7, day 10, and day 14. The schedule may vary depending on weather and coordination with the other survey work. Experimental carcasses should be marked discreetly (for example with dark electrical tape around one or both legs) for recognition by searchers and other personnel but not to influence scavenging rates. Experimental carcasses should be left at the location until the end of the carcass removal trial.

The number of carcasses to use should depend on the target precision for fatality estimates, variation in habitat and observers, and other factors. Care should be taken not to seed the area with so many trial carcasses as to greatly increase the scavenging rates in the area.

Analysis

The estimate of the total number of wind turbine-related fatalities should be based on three components: 1) observed number of carcasses, 2) searcher efficiency expressed as the proportion of trial carcasses found by searchers, and 3) removal rates expressed as the length of time a carcass remains in the study area and is available for detection by searchers, and possibly factors such as the 4) proportion of casualties likely to land or move outside the plot (such as forested portions beyond the cleared area surround turbines), 5) an estimate of the number of carcasses found by observers where cause of death could not be attributed to wind energy development. Specific definitions and calculations are presented in Appendix II.

Monitoring Protocol for Forested Sites

Any landscapes with dense forest cover pose significant problems with regards to assessing fatalities underneath wind turbines. The methods outlined above were developed for grasslands in the western United States and have been used at sites where clearings were maintained around turbines of at least 30 meters (Erickson pers. Comm.). Such methods are not effective in forested areas due to the inability of observers to actually find carcasses that may be hidden in dense cover or within the canopy of the surrounding trees. Therefore, alternative methodologies need to be developed for such terrain.

Maine could be a leader in the development of such protocols if flexibility in study protocols were allowed in forested landscapes. Technological advances in the use of thermal imaging cameras for identifying bat mortality could be adapted for use in estimating both bird and bat mortality if used in conjunction with radar. Under this scenario, the combined equipment would provide an opportunity to quantify mortality risk by directly assessing the frequency and number of strikes as observed with thermal imagery cameras with the numbers of targets moving through the project area airspace as documented with the radar system. However, the current methodology has not been adequately tested to date, is costly, and requires intensive data storage capabilities. Consequently, a peak migration period, 4 to 5 night, synchronized radar/thermal imagery sampling effort may be the most appropriate approach to assessing mortality in forested landscapes.

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APPENDIX I. MAINE WILDLIFE WIND POWER ADVISORY GROUP PARTICIPANTS

Name		Affiliation
Dave	Cowan	UPC Wind Management, LLC
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Tom	Hodgman	Maine Dept. of Inland Fisheries & Wildlife
Jody	Jones	Maine Audubon
Ken	Kimball[1]	Appalachian Mountain Club
Nick	Livesay[2]	Pierce Atwood
Larry	Miller	U.S. Fish & Wildlife Service
Kim	Morris[1]	Maine Dept. of Inland Fisheries & Wildlife
Gil	Paquette	TRC Environmental Corp.
Steve	Pelletier	Woodlot Alternatives
Dave	Publicover	Appalachian Mountain Club
Gordon	Russell[1]	U.S. Fish & Wildlife Service
Marcia	Spencer-Famous	Maine Land Use Regulation Commission
Mark	Stadler	Maine Dept. of Inland Fisheries & Wildlife
Sally	Stockwell	Maine Audubon
Steve	Timpano[1]	Maine Dept. of Inland Fisheries & Wildlife

[1]Not able to attend
[2]Observor

APPENDIX II. MAINE WIND POWER SITING STAKEHOLDER COMMITTEE PARTICIPANTS

Name		Affiliation
Chip	Ahrens	Attorney for wind power developers
John	Banks[1]	Penobscot Indian Nation
Jenn	Burns	Maine Audubon
Patrick	Corr	Maine Chapter of The Wildlife Society
Dave	Cowan	UPC Wind Management, LLC
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Marcia	Spencer-Famous	Maine Land Use Regulation Commission
Steve	Timpano	Maine Dept. of Inland Fisheries & Wildlife
Barbara	Vickery[1]	The Nature Conservancy

[1]Not able to attend
[2]Observer

APPENDIX III. CALCULATING NUMBERS OF BIRD AND BAT FATALITIES AT WIND TURBINES

Definition of Variables

The following variables are used in the equations below:

- c_i the number of carcasses detected at plot i for the study period of interest (e.g., one year) for which the cause of death is either unknown or is attributed to the facility
- n the number of search plots
- k the number of turbines searched
- $\bar{c}$ the average number of carcasses observed per turbine per year
- s the number of carcasses used in removal trials
- s_c the number of carcasses in removal trials that remain in the study area after 40 days
- se standard error (square of the sample variance of the mean)
- t_i the time (days) a carcass remains in the study area before it is removed
- $\bar{t}$ the average time (days) a carcass remains in the study area before it is removed
- d the total number of carcasses placed in searcher efficiency trials
- p the estimated proportion of detectable carcasses found by searchers
- I the average interval between searches in days
- $\hat{\pi}$ the estimated probability that a carcass is both available to be found during a search and is found

m the estimated annual average number of fatalities per turbine per year, adjusted for removal and observer detection bias.

Observed Number of Carcasses

The estimated average number of carcasses ($\bar{c}$) observed per turbine per period of interest is:

$$\bar{c} = \frac{\sum_{i=1}^{n} c_i}{k}. \tag{1}$$

Estimation of Carcass Removal

Estimates of carcass removal are used to adjust carcass counts for removal bias. Mean carcass removal time ($\bar{t}$) is the average length of time a carcass remains at the site before it is removed:

$$\bar{t} = \frac{\sum_{i=1}^{s} t_i}{s - s_c}. \tag{2}$$

This estimator is the maximum likelihood estimator assuming the removal times follow an exponential distribution and there is right-censoring of data. In our application, any trial carcasses still remaining at the end of the trial period are collected, yielding censored observations. If all trial carcasses are removed before the end of the trial, then s_c is 0, and $\bar{t}$ is just the arithmetic average of the removal times.

Estimation of Observer Detection Rates

Observer detection rates (i.e., searcher efficiency rates) are expressed as p, the proportion of trial carcasses that are detected by searchers. Observer detection rates were estimated by carcass size and season.

Estimation of Facility-Related Fatality Rates

The estimated per turbine annual fatality rate (m) is calculated by:

$$m = \frac{\bar{c}}{\hat{\pi}}, \tag{3}$$

where $\hat{\pi}$ includes adjustments for both carcass removal (from scavenging and other means) and observer detection bias assuming that the carcass removal times t_i follow an exponential distribution. Data for carcass removal and observer detection bias were pooled across the study to estimate $\hat{\pi}$. Under these assumptions, this detection probability is estimated by

$$\hat{\pi} = \frac{\bar{t} \cdot p}{I} \cdot \left[\frac{\exp\left(I/\bar{t}\right) - 1}{\exp\left(I/\bar{t}\right) - 1 + p} \right].$$

Other adjustments to m may include reference mortality adjustments, or adjustments for the likelihood of carcasses occurring outside the search plot. Fatality estimates are typically calculated for: (1) all birds, (2) small birds, (3) large birds, (4) raptors, (5) nocturnal migrants, and (6) bats, and other groups of interest (e.g., resident songbirds). The final reported estimates of m and associated standard errors and 90% confidence intervals are calculated using bootstrapping (Manly 1997). Bootstrapping is a computer simulation technique that is useful for calculating point estimates, variances, and confidence intervals for complicated test statistics. For each iteration of the bootstrap, the plots were sampled with replacement, trial carcasses were sampled with replacement, and $\bar{c}$, $\bar{t}$, p, $\hat{\pi}$, and m were calculated. A total of 5,000 bootstrap iterations were used. The reported estimates are the means of the 5,000 bootstrap estimates. The standard deviation of the bootstrap estimates is the estimated standard error. The lower 5th, and upper 95th percentiles of the 5000 bootstrap estimates are estimates of the lower limit and upper limit of 90% confidence intervals.

APPENDIX IV. COMPARISON OF X-BAND AND S-BAND RADAR FOR STUDYING NOCTURNAL MIGRATION OF WILDLIFE

Factors	x-band	s-band
Detectability	Smaller targets picked up	Good for waterfowl & larger birds
	Includes insects	No insects
	Includes songbirds	Limited data on songbirds
Range	Shorter range (.9 nautical miles for robin-sized and .6 nautical miles for smaller targets)	Longer range (up to 4 km)
Automation	Yes: need to differentiate bird, bat & insects using flight speed not target size which changes as aspect changes.	Yes: mostly used in conjunction with x-band in vertical mode simultaneously with s-band. Geomarine (FL) and Detect --only automated users
Weather	Rain drops detected so cannot differentiate bird targets. Not effective in some weather conditions	Can see through rain
Mode of operation	Horizontal or Vertical	Could be used in horizontal in conjunction with x-band in the vertical?
Types of data	• Horizontal passage rate • Flight direction • Flight speed • Vertical passage rate • Flight height	• Horizontal passage rate • Flight direction • Flight speed
Other	• Smaller antenna • Greater portability • Lower cost • Currently more available data sets to compare to	• Lower sensitivity to ground & background clutter

GOVERNOR
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February 28, 2009

Enclosed please find responses to wildlife questions posed by the public at DEP's public informational meeting in Lincoln on February 11, 2009 regarding the Rollins Mt. Windpower Project.

Bird & Bat Studies: Justification for only surveying Rollins Mountain and not the Rocky Dundee area.

Initially the Rocky Dundee area was to be a separate phase of the project and was initially referred to as Rollins II. MDIFW based it's suggested survey efforts to the Applicant for the Rollins Mt. area (Rollins I). At some point the Applicant made the decision to combine the two areas into one project. The Applicant's wildlife consultants, Stantec Consulting Services Inc. met with MDIFW to discuss the need for two separate sets of studies given the proximity of the two ridgelines. It should be noted that there are other windpower projects in the State where this issue has also been discussed.

It was MDIFW's position that given the close proximity between Rollins Mountain and the Rocky Dundee area that there was no need to duplicate studies. Passage rates and flight heights were believed to be similar given the close proximity of the Rollins and Rocky Dundee sites. In fact, these two metrics are quite similar to those recorded at the Stetson, Oakfield, Mars Hill, and Number Nine projects. It should be noted that MDIFW required no additional preconstruction studies for birds and bats for the second phase of the Stetson Mountain Windpower project.

Eagle Nests: Upper Pond and Folsom Pond and potential issues:

The eagle nest on Upper Pond (BE468A) is approximately one mile from the closest string of wind turbines proposed for the Rocky Dundee area. MDIFW does have concerns regarding windpower projects being located appropriately as it concerns eagle nests. MDIFW will be advocating for post-project monitoring with this and other windpower projects where these projects neighbor the outskirts of an eagle territory. MDIFW is not aware of an eagle nest on Folsom Pond.

Need For A More Comprehensive Avian Research Effort:

The avian studies, requested of the Applicant are consistent with what is being requested by MDIFW for other windpower projects in Maine and are similar in scope and focus around the country. In some instances MDIFW is requiring more than is being asked by other states. Additional studies that lack objectives closely tied to evaluate risk to birds and bats, do not add value to a project, but instead may dilute other more carefully designed studies by drawing field effort away from them.

Appendix 7-2 BBS Topsfield Route: The route is too far away and not representative of the Project area:

The data associated with Appendix 7-2 was not requested by MDIFW. The survey route is not consistently run from year to year and only offers generalized information of some of the avian species found in the area. There is an additional BBS route that runs along Route 168 as it passes thru the town of Winn, before heading off to the east. This would be the closest BBS route to the Project area. In either case, it is unclear how species found on these routes would help understand what risk is posed by the proposed Project.

Loons: No direct studies or discussion included in the Application:

MDIFW did not request studies specific to loons. It is not anticipated that the local loon population, or migrating loons will be adversely impacted by the Project. Post-construction mortality studies will document any loon mortalities, though it is unlikely any will occur.

What Are The Acceptable Levels of Mortality on Birds, Bats, and Raptors:

This is a difficult question to answer. Avian migration through Maine (and theoretically bat migration as well)is fairly diffuse, typically referred to as "broad front" migration. In mountainous regions, high peaks such as those over 3,000 to 4,000 feet may influence bird movement locally by diverting passage of some individuals around, rather than over summits. Such behavior has not been seen for smaller mountains and ridgelines such as at Rollins and Stetson Mountain. The challenge facing MDIFW is that there are only two other operating windpower projects in Maine, and the Stetson Project only began operations in January 2009. Therefore at this time with limited post-construction mortality data available, it is difficult to determine what level of avian mortality is expected, and more importantly what level of mortality is acceptable.

Mortality must be reviewed on a species by species basis. Is the species common? Does it breed in Maine or is it a transient? Is the population stable, increasing, or decreasing? What is the local, state, or regional perspective with regard to population size and trend? Is the species listed by MDIFW or the USFWS?

The larger question is not at the project-by-project level, but the cumulative impact statewide and over time. Post-construction mortality studies therefore become that much more important in an effort to answer this question. Another major question is how to use pre-construction surveys to better predict potential post-construction avian mortality. With more of these projects coming on line in Maine and neighboring states, MDIFW hopes to have a better understanding of this issue in the near future.

Vernal Pools: Impacts from construction and request for an independent study:

MDIFW works alongside the Applicant to develop or provide comment on vernal pool studies. Results of the survey effort are provided to MDIFW and potential conflicts or impacts are addressed. MDIFW's position on these habitats as well as other wildlife habitats included within the Natural Resources Protection Act (NRPA)are to avoid impacts, minimize impacts if avoidance is not possible, and to mitigate for lost habitat. Only Significant Vernal Pools (SVP)are addressed by the NRPA. SVPs include both the pool and a 250 foot buffer around the pool. In addition, under Site Location of Development, MDIFW recommends to DEP that there be less than 25% conversion impacts out to 500 feet around SVPs. In this instance, one SVP will not be impacted out to 500 feet. The other is estimated to have a total area impact of 19.2 % between the 250 and 500 foot area which meets the additional recommendations set forth between MDIFW and DEP.

Survey efforts for the Rollins Mountain Project included only two SVPs located in the vernal pool study. According to the Applicant, neither of these SVPs are within the Project area. MDIFW does not see the need for an independent study of the vernal pool survey effort, nor does it currently anticipate further surveys in the spring of 2009. In addition, MDIFW could not find any information in the Application that stated the "Applicant would remove all vegetation that is 8-10 feet or taller and within 750 feet of the vernal pool. The remaining vernal pools while not regulated by DEP may still be regulated by the Army Corps of Engineers.

According to Stantec, a minimum 75-foot buffer, as measured for the edge will be established for SVPs, vernal pools, and potential vernal pools crossed by the transmission line. There will be no herbicide use within the 75 foot buffer. Prior to construction, only capable trees greater than 8-10 feet tall will be removed. No other vegetation, other than dead or danger trees will be removed. In summary, clearing the ROW will not result in greater than 25% of the vernal pool habitat envelope being impacted.

Bats & Barotrauma:

MDIFW is aware of some studies that link barotrauma in bats to windpower projects. However, MDIFW feels that the more important question is the overall bat mortality related to the Rollins Windpower Project, and other windpower projects in the State.

Degradation of Wildlife Habitat:

MDIFW's focus is on habitats associated with endangered, threatened, or species of special concern, and habitats included as Significant Wildlife Habitats under the NRPA. Specific to the Rollins Project, this includes, SVPs, Inland Waterfowl/Wadingbird Habitats (IWWH), Deer Wintering Areas (DWA), and the bald eagle nest (BE468A). MDIFW does not focus on the general habitats types associated with the Project area, most of which is working forest intersected with gravel roads, or already developed to some degree.

Both IWWHs and DWAs are identified with the proposed powerline that would run from Rollins Mountain north to Mattawamkeag. MDIFW is working with the Applicant to avoid, minimize (and if necessary mitigate for) negative impacts to these two habitat types.

Can Bat Populations Sustain Huge Loses of up to 5 Million per Year:

This question appears to be of a national scope. MDIFW is focused on the Rollins Project and the other windpower projects in Maine. It does not have the information to answer such an all encompassing question or to comment on the accuracy of the statement.

As previously stated, to date only the Mars Hill Windpower Project has provided any post-construction bat mortality data for Maine. In 2007, 24 bat fatalities were found and associated with the Project and five in 2008. After reviewing and including data from searcher efficiency trails and scavenger carcass removal trials, an estimate of 19 bat fatalities per year was estimated for the Mars Hill Project. Again, MDIFW is not only concerned about bat fatalities at the project level, but at the statewide level as well.

Effects of the Project on Canada Lynx:

MDIFW considers the lynx to be transitory within the Rollins Mt. Project area. MDIFW does not foresee any negative impacts on lynx due to project construction or operations.

Evaluation of Lakes and Ponds within Five Miles of the Project Area Utilizing the Maine Wildlands Lakes Assessment.

The Maine Wildlands Lake Assessment is a documented completed in 1987 and was part of an effort by the Land Use Regulation Commission (LURC) to establish a systematic base of natural resource and land use information for lakes ten acres or greater within LURC jurisdiction.

While the Assessment did include information on fisheries and wildlife, the majority of issues was not specific to MDIFW's Legislative mandate and were more pertinent to regulatory agencies such as LURC, DEP, and local Planning Boards. In addition, the intent of the work was specific to lakes and associated riparian and shoreland areas.

The proposed Project is not expected to negatively impact any wildlife or fisheries resources specific to any of the lakes or ponds in the area, or their associated shoreline and riparian areas.

Mark A. Caron
Regional Wildlife Biologist
Region F-Enfield

Received 3-5-09

GOVERNOR
John E. Baldacci

COMMISSIONER
Roland D. Martin

Wildlife Division
73 Cobb Road
Enfield, ME 04493

February 28, 2009

Enclosed please find comments from Maine Department Inland Fisheries and Wildlife (MDIFW) in response to Stantec Consulting Services (Stantec), comments included in their February 3, 2009 response to DEP. Stantec's comments were in response to MDIFW's original comments included in their January 5, 2009 document to DEP regarding the Rollins Wind Project. Comments are specific to Section 7 Wetlands, Wildlife and Fisheries. The comments enclosed address vernal pools, bird and bat studies for 2007 and 2008, inland waterfowl/wadingbird habitats (IWWH), and deer wintering areas (DWAs), and post-construction monitoring.

Vernal Pools:

Fifty-eight vernal pools were located within the project area with only two of these pools meeting the criteria for designation as Significant Vernal Pools (SVP). As stated in the application, there are no impacts from the project to either of the SVPs out to 250 feet. One SVP will have a 19.1 % impact between 250 and 500 feet which is acceptable according to the guidelines developed by MDIFW and DEP. There are no further concerns or comments at this time regarding these habitats from MDIFW.

Inland Waterfowl/Wadingbird Habitats (IWWH):

The final BMP document for ROWs agreed to by industry, DEP, and MDIFW will guide activities within IWWHs. In addition, these IWWHs are rated as either High or Moderate Value as defined within the Natural Resources Protection Act (NRPA) and therefore receive the full protection provided for in the NRPA. Any negative impacts to these Significant Wildlife Habitats will be addressed and including potential mitigation measures for loss of habitat and function.

Bird, Bat, and Raptor Studies:

MDIFW still has concerns regarding bird, bat, and raptor (including eagles) mortality associated with the Rollins Windpower Project.

Post-construction mortality studies will help address overall mortality rates and negative impacts to these species. These studies will be designed to provide information that can be used to offset potential mortality due to Project operations by implementing strategies used in the daily operations of the Project.

Deer Wintering Areas:

The Applicant will follow the guidelines according to the ROW BMP document currently being drafted by industry, MDIFW, and DEP. It cannot be underestimated that the negative impacts from windpower ROWs (or any ROW) is a major concern to MDIFW. With the numerous windpower projects being developed or proposed, and the fact that these Applicants refuse to, or cannot share the same ROW creates a major problem as more and more DWAs will be lost or so severely fragmented that they cease to provide the cover and travel corridors so important for wintering deer. Travel corridors across the ROW may be an option, however if the Applicant will not allow the vegetation (trees) to grow to a height such that they function to intercept snow and wind to the benefit of wintering deer, then they are of marginal, if any benefit.

Avian and Bat Casualty Monitoring Protocol:

MDIFW would like to amend its January 5, 2009 comments to DEP regarding the post-construction avian and bat mortality studies and protocol. While MDIFW looks forward to working with the Applicant on this important phase of the Project, it has not formally reviewed the draft proposal submitted and included in Appendix 7-5 of the Application. Nor has MDIFW conferred with the Applicant regarding the specifics of the draft protocol submitted. It should be noted that in Appendix 7-5, the Applicant states that "….these surveys will be developed in consultation with MDIFW between the time that construction is initiated and the first spring survey period that occurs after construction". The draft proposal included in Appendix 7-5 is a good starting point for discussions.

The survey protocol is an ever-evolving process as we learn more from other studies and the one existing study conducted by the same Applicant at the Mars Hill site. MDIFW is currently working with the same Applicant on post-construction studies for the Stetson I windpower project. Once this is completed, MDIFW will begin discussions with the Applicant for the Rollins Project. It is MDIFW's intent on attempting to standardize to the extent possible the studies and protocol for these post-construction efforts.

Maddox, Becky

From: Caron, Mark
Sent: Tuesday, March 03, 2009 11:18 AM
To: Maddox, Becky
Subject: RE: Rollins Wind project

Hi Becky,

I addressed this topic in a general way. The reality is that we will not finalize a post-construction plan until after the permit is given. However, we have their draft plan in Appendix 7-5 and that's all it is, a draft. At the same time we are working with the same Applicant on the plan for Stetson I and we hope to standardize as much as possible between the two projects.

I am basically done with all the questions sent to me and also the response to Stantec document. However, with both documents I have some vernal pool questions and I am currently waiting on someone from Stantec to send me that info so that I can finish out the vernal pool sections in both those documents. Got all that?

I'll get them to you as soon as I can.

Thanks,
Mark

From: Maddox, Becky
Sent: Friday, February 27, 2009 10:24 AM
To: Caron, Mark
Cc: Timpano, Steve
Subject: Rollins Wind project

Hi Mark,
According to the application, it states that a protocol for post-monitoring bird and bat studies will be conducted in accordance with IF&W's recommendations. If you have not done so already in the comments you will be submitting soon, could you please elaborate on what these recommedations are? (ie when should the study should begin? duration of the study? what will the study entail? etc...) I would greatly appreciate it!

Thanks for all of your hard work on this project!

Becky

Maine Department of Inland
Fisheries and Wildlife
73 Cobb Road
Enfield, Maine 04493

Telephone: 207-732-4131
Fax: 207-732-4405
Email: Richard.dill@maine.gov

John Elias Baldacci, Governor

Roland D. Martin,
Commissioner

Date: March 9, 2009

To: Becky Maddox

From: Richard Dill

Re: Rollins Wind Power Project #L-24402 – Response to February 11, 2009 Public Meeting Questions

Becky,

This letter addresses two requests that arose during the public meeting held February 11, 2009 concerning the Rollins Wind Project.

1.) A comprehensive biological study for each lake with in five miles (of the project) should be done using standards in the Maine Wildland Lake Assessment Work Plan – (these ponds are on the list).

Fishery Comments: The Rollins Mountain Wind Project falls outside of LURC jurisdiction, and therefore LURC standards for land use and development do not apply. Based on the initial review of the Rollins Wind project area and design with regard to impacts to fish and/or fish habitat it was determined that there were no great ponds lying within the project boundaries, and that the impact to fish and/or fish habitat of great ponds in the areas adjacent to the project would be none or insignificant. At this time MIFW does not request such studies for the lakes adjacent to the project boundary.

2.) An evaluation of all lakes with in three miles of the project using Wildland Lakes Assessment technique or a baseline of information is needed to accurately evaluate the changes in unique and rare species.

Fishery Comments: Similar response to above, LURC standards do not apply. No unique or rare fish or fish habitats are known to occur in these areas, therefore MIFW does not request that such studies be conducted at this time.

Sincerely,

Richard Dill, Regional Fishery Biologist

MIFW – Region F, Enfield

Maddox, Becky

From: Timpano, Steve
Sent: Friday, March 13, 2009 2:38 PM
To: Dill, Richard
Cc: Caron, Mark; Maddox, Becky
Subject: RE: Rollins Wind - Lincoln

Richard:

Sorry for delay. Had this started last week, got diverted, and simply forgot to get back to it. To recopy the questions:

"Other Studies"

"Comprehensive biological study for each lake w/in 5 miles should be done using standards in Maine Wildland Lake Assessment Work Plan- these ponds are on the list."

"Evaluation of all lakes w/in 3 miles of the project using Wildland Lakes Assessment technique or a baseline of info. needed to accurately evaluate the changes on unique and rare species. Can we use stimulus $ to do independent studies of the area? - Mary Beth Nolette"

Timpano response: You are tapping (and taxing) institutional memory here...! I dug out and took a look at my copy of the 1986 Maine Wildlands Lake Assessment Work Plan (yes, I still have a copy on my bookshelf...). First, it's not clear to me what anticipated changes to biological communities associated with the lakes are anticipated as a result of the project, or second, how assessment and evaluation criteria and protocols utilized in the Wildlands Lakes Assessment Work Plan would help establish a baseline for existing conditions.

To date we have not seen any indication that unique and rare species (other than possibly local-area Bald Eagles or some species of bats) are or may be substantially at risk outside of the immediate project area. Questions about possible effects upon local-area populations of Bald Eagles have been raised previously, but there is little available precedent data upon which to base risk assessment. We are considering tailoring post-construction monitoring studies to specifically include provisions for evaluation of local eagle populations in addition to our more routine turbine-mortality survey recommendations. We're also now re-evaluating possible effects upon local bat populations. As more information becomes available this may lead to specific recommendations for more local-population bat studies in the future, but not at this time. Adverse effects upon other rare and unique species outside of the immediate project construction and operations areas have to date not been identified as a substantial concern.

The 1986 Wildlands Lakes Assessment was done at a very broad and very coarse screening level. It relied primarily upon existing available information, not detailed new surveys. The criteria and protocols developed for that effort were simply not sophisticated enough to provide a "comprehensive biological study" or baseline data that could be accurate enough to indicate project development and operation-related changes. And as above, specifically what changes are anticipated? I'm not aware that substantive concerns for rare and unique species outside of the immediate project areas have been identified by any of our species-specialist staff in our project reviews to date.

Hope this helps. Steve T.

From: Dill, Richard
Sent: Thursday, March 05, 2009 11:22 AM
To: Timpano, Steve

Subject: Rollins Wind - Lincoln

Steve,
Attached are questions that arose from a public meeting held several weeks ago concerning the Rollins Wind project in Lincoln. The last two questions/requests under "Other Studies", refer to potential impacts to lakes outside of the project area. The person asking the questions requested assessing the impacts to the biological community of lakes within 5 miles of the project as well as impacts to rare and unique species in lakes within 3 miles of the project. They are suggesting using the Maine Wildland Lake Assessment Work Plan (LURC) for these assessments.

I have already commented on the potential impacts of the project on fisheries (essentially none --- see attachment) and noted that no lakes or ponds fall within the project area. My position is that these studies are unnecessary since we have already determined that no lakes and ponds fall within the project area and that the impacts to the lakes and ponds adjacent to the project area will be minimal if any. Becky Maddux would like me to comment on these two questions/requests…

Any advice you can provide as to how I should be reply is greatly appreciated.

Richard

From: Caron, Mark
Sent: Friday, February 20, 2009 8:57 AM
To: Dill, Richard
Cc: Maddox, Becky
Subject: FW: two more questions...

Richard,

At the very bottom of the document please find two questions that are more in your area of expertise that stem from the Rollins Mt. public hearing held last week and hosted by DEP. Becky would like a response back to her for these two questions as part of the public record. Deadline is the 28th. We can discuss, but I have no knowledge of this Lake Assessment Plan that they are referring to.

thanks

From: Maddox, Becky
Sent: Thursday, February 19, 2009 3:36 PM
To: Caron, Mark
Subject: two more questions...

Hi Mark,
I am really sorry, but I came across two additional questions regarding other studies that one of the folks was asking about in her testimony. Please respond to these questions as well.

I understand that I am asking you to answer a lot of questions, so if you need a little more time, please just let me know.

Thanks,

Becky

Stantec

FAX to 287-7826

TO: James Cassida, MDEP
FR: Brooke Barnes, Stantec Consulting
DA: April 14, 2009

Jim

We recently received these comments from USFWS in response to a public notice for the Army Corps permitting regarding the Rollins Wind Project. We've discussed the comments with USFWS, and are meeting with USFWS and the Corps to resolve the concerns. While the USFWS input is being evaluated in the course of the Army Corps permitting, MDIFW was also copied on the letter so I wanted to make DEP aware of the comments.

Brooke

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Maine Field Office – Ecological Services
1168 Main Street
Old Town, ME 04468
(207) 827-5938 Fax: (207) 827-6099

In Reply Refer To: 53411-2009-TA-0045
FWS/Region5/ES/MEFO

April 3, 2009

Rodney A. Howe
Maine Project Office
U. S. Army Corps of Engineers
675 Western Ave. #3
Manchester, Maine 04351

Dear Mr. Howe:

This letter is in response to your 20-day notice for Evergreen Wind Power III, LLC dated February 10, 2009. This notice was to obtain comments on a project to construct 40 wind turbine towers on Rollins North and Rollins Mountain and Rollins south along Rocky Dundee ridges in Lincoln, Burlington, Lee, Winn, and Mattawamkeag Maine. The project is for a 60-megawatt wind project consisting of 40 turbines and 4 permanent meteorological towers. The project includes upgrades to existing logging roads and a 5.4 mile transmission line and an 8.8 mile segment of transmission line. (14.2 miles of right-of-way). We have reviewed the applicant's project information and are providing comments in accordance with Section 7 of the Endangered Species Act (ESA), as amended (16 U.S.C. 1531-1543), Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d, 54 Stat. 250)(Eagle Act), Migratory Bird Treaty Act (16 U.S.C. 703-712)(MBTA), and the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667d).

Federally listed species

Atlantic salmon

The project is located within the proposed expanded Gulf of Maine DPS and critical habitat for the Atlantic salmon. It is anticipated that these rules will be finalized later this spring. As discussed previously, this project will likely require informal Section 7 consultation when these rules become effective. We are reviewing additional information received from the applicant related to salmon and will continue to coordinate with the Corps to complete Section 7 consultation after the salmon rules become effective.

Other protected species

We have not reviewed this project for state-threatened and endangered wildlife, wildlife species of special concern, and significant wildlife habitats protected under the Maine Natural Resources Protection Act. I recommend that you contact the Maine Department of Inland Fisheries and Wildlife

Steve Timpano
Maine Department of Inland Fisheries and Wildlife
284 State St.
State House Station 41
Augusta, ME 04333-0041
Phone: 207 287-5258

I recommend that you contact the Maine Natural Areas Program for additional information on state-threatened and endangered plant species, plant species of special concern, and rare natural communities.

Lisa St. Hilaire
Maine Natural Areas Program
Department of Conservation
93 State House Station
Augusta, ME 04333
Phone: 207 287-8046

Bald eagles

Bald eagles (*Haliaeetus leucocephalus*) nest on an island in the southwest corner of Upper Pond. Nineteen turbines are located within 2 miles of the nest. Twelve turbines are located within 1.5 miles of the nest. The closest turbines are located 1.1 miles from the nest. Part of this project is likely within the home range of this nesting pair of eagles. The application (p. B-8) states "no nests are known to occur within the Rollins Project area." The application does acknowledge 8 known bald eagle nests within approximately 5 miles of the project area, including 7 along the Penobscot River and the Upper Pond nest.

The project lies within a complex of shallow, warm water lakes that provide nesting and foraging habitat for bald eagles including Folsom, Crooked, Madagascal, Mattakeunk, Cold Stream Center, Caribou, Egg, and Long Ponds. Eagles are frequently seen on these lakes, but they have not been surveyed for nesting eagles in recent years. A number of proposed turbines lie directly in the flight path between Upper Pond and Madagascal Pond. The Upper Pond eagles likely use both ponds for foraging and pass regularly over these ridges.

Based on the following survey results, we are concerned by the risk this project will have on bald eagles. In the fall of 2007 12 days of raptors surveys were completed and in the spring of 2008 15 days of surveys were conducted. Both surveys were conducted on Rollins North Mountain approximately 5.8 miles north of the Upper Pond eagle nest. Average raptor passage was 1.8

birds/hour in 2007(fall) and 1.1 raptors/hour in 2008(spring). In 2007 21 of 144 raptors observed were bald eagles and in 2008 9 of 122 raptors were bald eagles. In 2007 82% of raptors were below 120 m potential (rotor swept zone) and in 2008 76% were potentially in the rotor-swept area. Many observations of raptors moving through the area, including eagles, were potentially in the rotor-swept zone.

The applicant provided no information on bald eagle movements in the project area outside of the spring and fall migration period. The applicant did not document the movements of the eagles nesting on Upper Pond or search for eagles and nests on nearby ponds. Nearby shallow, warm water ponds likely support many non-breeding eagles and they could be present at any time of the year. Many turbines are likely within the home range of the Upper Pond eagles (and possibly other unknown nesting pairs). Nesting bald eagles and their recently-fledged young routinely make use of nearby topography to seek thermals and possibly travel to other nearby ponds to forage.

Wind energy projects can affect bald and golden eagles by direct take of resident or transient birds by collision with rotating turbine blades or by introducing new sources of disturbance (noise, human and machine noise during construction, permanent changes to the landscape, barriers to movement, increased human access). Furthermore, both bald and golden eagles may be attracted to openings around wind turbines to feed, particularly if sources of carrion (large birds killed by collisions) are present. Information from around the world suggests that wind projects can be of significant risk to eagles. Sea eagles (genus *Haliaeetus*) and golden eagles (Genus *Aquilla*) have been killed, sometimes in large numbers, at wind projects (see http://www.iberica2000.org/Es/Articulo.asp?Id=3071 for a summary).

The bald eagle was removed from the federal threatened list on August 9, 2007 and is now protected from take under the Eagle Act and the MBTA. "Take" means to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. The term "disturb" under the Eagle Act was recently defined within a final rule published in the Federal Register on June 5, 2007 (72 Fed. Reg. 31332). "Disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle; 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. At this time, neither the Eagle Act nor the MBTA permits incidental mortality of bald eagles because of collisions with wind towers. If the applicant believes take or disturbance is likely, they should contact our office for further guidance. A national permit for take from wind projects is being developed for the Eagle Act.

The Service has published a set of National Bald Eagle Management Guidelines. These guidelines are designed to give landowners and others clear guidance on how to ensure that actions they take on their property are consistent with the Eagle Act and MBTA. They are intended to help landowners avoid violating the Eagle Act by disturbing bald eagles. Wind power projects are not specifically addressed in the guidelines.

In summary, the Service is supportive of renewable resources and encourages efficient wind energy projects that are sited and operated to avoid and minimize take of birds and bats.

However, as expressed earlier in this letter, we are concerned about the potential risk that construction and operation of the proposed wind power facility may pose to bald eagles.

If the project is permitted by the Corps, the Service recommends the following measures should be considered to avoid and minimize take and disturbance of bald eagles:

1) do not place turbines within 1.5 miles from the Upper Pond eagle nest (on ridges between Upper and Madagascal Ponds),
2) feather (shut down) other turbines when eagles are present in the area
3) do not place turbines near other eagle nests or areas frequented by eagles.
4) no blasting or construction within 1 mile of active nests during the nesting period (February 15 to August 15) unless approved in writing from the Service.

Prior to construction (preferably spring 2009) there should be immediate surveys of Caribou, Egg, Long, Mattakeunk (Silver), Bill Green, Folsom, Madagascal, and Crooked Ponds for nesting eagles. Additional measures may be considered for any new nests found.

If the project is permitted by the Corps, we recommend the following monitoring:

1) annual monitoring of occupancy and nest success of the of the bald eagle nest at Upper Pond and other nesting sites within 3 miles of the project,
2) continual studies of movements of resident and non-nesting bald eagles in the project area including during non-migratory periods,
3) Allow brush or forest to grow around the base of turbines so large bird carcasses are not visible to foraging eagles

We encourage early and frequent consultations to avoid take of eagles. If you have any questions, please call Mark McCollough, endangered species biologist, at (207) 827-5938 ext.12.

Sincerely,

Wende S. Mahaney

Wende Mahaney for
Lori Nordstrom, Project Leader
Maine Field Office

cc: Ryan Chaytors, Evergreen Wind Power
Charlie Todd, MDIFW
Mark Caron, MDIFW